Washington State Ferries
Total Risk Management

Date: January 6, 2005

Subject: Keystone Cost Range Estimates and Risk Analysis

Overview

Cost Range Estimates were developed for Keystone options 'NP-1, New Vessel with Special Propulsion in Existing Harbor'; 'KS-1, Keystone Special in Existing Harbor'; '130-2, Issaquah 130 Class with a Jetty Extension'; and '130-7, Issaquah 130 Class with a Jetty Relocation'. The Cost Range Estimates were developed to be consistent with WSF's Total Risk Management and Cost Estimate Validation Process (CEVP) philosophies.

Cost estimates were developed using standard contingencies for elements that could be estimated with a reasonable degree of certainty. Risk factors were applied to cost elements that possessed a greater amount of uncertainty. There were six primary risk factors for the vessel analysis that included: 1) vessel design uncertainty, 2) vessel technology uncertainty, 3) vessel 'life cycle / maintenance' uncertainty, 4) vessel damage potential, 5) vessel operational uncertainty, and 6) vessel interchange-ability. Environmental mitigation cost and permit-ability were the primary risk factors for the terminal estimates.

High, low, and mean cost estimates were developed and modeled based on the existing cost estimate for the four options above and were analyzed in 'constant dollars'- base year 2004, 'current dollars'- year of expenditure (YOE), and in 'present value dollars' - (PV). The low-end estimates were developed by removing the estimated contingencies. Applying the above noted risk factors developed the high-end estimates. This approach is consistent for a project in the 'study' phase and prior to completing the environmental and preliminary design phases. The calculated 'mean' estimate is the budget that would have a 50% confidence level. The 5% and 95% confidence levels are noted in the probability distribution graphs as part of this appendix. Generally, larger cost ranges represent larger cost uncertainties and greater risk.

Additional Risks

- The final decision has not been determined at this point in project's lifecycle creating a wide range of possible cost estimate outcomes and project durations.
- The 'NP-1, New Vessel with Special Propulsion' and the 'KS-1, Keystone Special' vessel options are not currently funded and would require the Legislators to redirect funding if one of these options are chosen.
- An alternative outside the harbor may be required to be studied as a requirement of the environmental review process and could have cost and schedule impacts.
- Cultural Resources may be discovered as part of the construction required to support the widening of the harbor or rebuilding the terminal which could cause a schedule delay.

- There are at least two risks associated with obtaining the required US Army Corps of Engineers (USACOE) approval to modify the Keystone Harbor. Each poses a cost and schedule risk.
    - The first risk is getting the local USACOE approval of the project's cost/benefit and environmental impacts prior to sending the project to USACOE Headquarters for funding. If the cost is over $4 million it will require US Congressional approval.
    - The second risk is negotiating a new harbor dredging maintenance agreement with USACOE to dredge the harbor on a periodic basis. This is primarily a cost risk.

Risk Strategies

The primary strategy to actively manage the uncertainty regarding the range of possible vessel cost outcomes for each vessel option will be to continue further research into technical requirement and capabilities of each option then develop refined cost estimates based on the finding.

The primary strategy to actively manage the uncertainty regarding the environmental mitigation cost uncertainty and the permit-ability uncertainty will be to request additional funding to prioritize the areas that drive the uncertainty then perform additional technical analysis to quantify and reduce the uncertainty. In doing so, the project team will continue to work closely with the resource agencies, services, affected tribes, and the US Army Corps of Engineers to define the permit-ability issues.

The primary strategy to understand if 'alternatives outside the harbor' may be required to be studied as a requirement of the environmental review process will be to further analyze the requirements and to educate the key stakeholders on the requirements of the State Environmental Protect Act (SEPA) and the National Environmental Protect Act (NEPA) so more informed decisions could be made.

The primary strategy to mitigate the cultural resources uncertainty will be to work closely with the affected tribes to develop a plan to perform additional investigation in the areas likely to be affected by construction then implement the plan. This will be done to determine the likelihood, look at ways to avoid areas that are determined to be high risk, discuss potential mitigation options along with appropriate actions and implications associated with finding any cultural resources.

The primary strategy to actively manage the uncertainty regarding the USACOE approval to modify the Keystone Harbor' will be to work closely with the USACOE to better understand their process and work with them to identify the areas within the process that risk and uncertainty exist, then develop strategies to actively manage each area of risk or uncertainty.

Cost Range Estimates Summary

Below are the summaries of Cost Range Estimates for each option in 'constant 2004 dollars', 'current year of expenditure (YOE) dollars', and in 'present value (PV) dollars':

Cost Range Estimates Per Option by Dollar Type				
	Low-end Estimate	**Existing Estimate**	**Mean Estimate**	**High-end Estimate**
Constant Dollars				
NP-1	$ 390.2	$ 431.8	$ 461.5	$ 562.4
KS-1	$ 472.8	$ 523.6	$ 545.1	$ 639.0
130-2	$ 393.4	$ 440.3	$ 435.7	$ 473.4
130-7	$ 380.1	$ 422.5	$ 419.4	$ 455.7
Current Dollars				
NP-1	$ 760.6	$ 841.0	$ 897.3	$ 1,090.3
KS-1	$ 957.2	$ 1,064.0	$ 1,103.7	$ 1,294.4
130-2	$ 731.0	$ 824.0	$ 808.4	$ 877.4
130-7	$ 704.7	$ 804.8	$ 792.0	$ 866.4
PV Dollars				
NP-1	$ 221.3	$ 245.1	$ 263.1	$ 323.0
KS-1	$ 257.4	$ 285.2	$ 297.1	$ 348.8
130-2	$ 228.6	$ 256.7	$ 253.9	$ 276.4
130-7	$ 216.1	$ 242.2	$ 240.1	$ 261.9

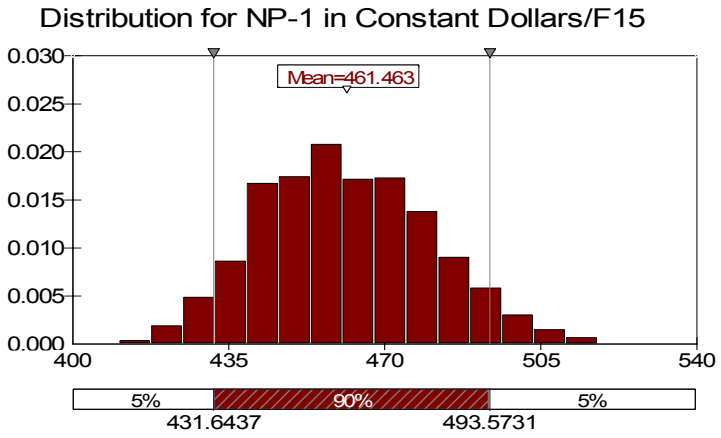
Current dollars for KS-1 and 130-2 have been rounded to be consistent with page 18 of Cost Analysis of Alternative Courses of Action', dated January 5, 2005.

See the Probabilistic Cost Range Estimate Graphs on pages that follow.

Option: NP-1 'New Vessel w/ Special Propulsion' - In Existing Harbor - In Constant Dollars

		Low-End Estimated Cost in 2004 Dollars	Estimated Cost in 2004 Dollars	High-End Estimated Cost in 2004 Dollars	Mean Estimated Cost in 2004 Dollars	High-End Risk Factors Total
NP-1	**New Vessel w/ Special Propulsion'**					**0.30**
	Terminal Construction	$ 5.2	$ 6.9	$ 7.4	$ 6.5	0.07
	Terminal Preservation	$ 19.7	$ 20.7	$ 22.8	$ 21.0	0.10
	Terminal Maintenance	$ 2.4	$ 2.5	$ 2.8	$ 2.5	0.10
	Terminal Operations	$ 14.5	$ 14.5	$ 16.0	$ 15.0	0.10
	Vessel Construction	$ 94.1	$ 104.6	$ 156.9	$ 118.5	0.50
	Vessel Preservation	$ 68.3	$ 75.9	$ 117.6	$ 87.3	0.55
	Vessel Maintenance	$ 30.3	$ 33.7	$ 52.2	$ 38.7	0.55
	Vessel Operations	$ 155.7	$ 173.0	$ 186.8	$ 171.8	0.08
	Range	**$ 390.2**	**$ 431.8**	**$ 562.4**		
			Mean Cost in 2004 Constant Dollars		**$ 461.5**	

Low-end of Terminal Construction Cost Removes 30% Design Contingency
Low-end of Vessel Cost Removes 'Assumed' 10% Contingency
High-end of Vessel Cost is based on a composite of 6 Risk Factors
All Estimated Costs came from Keystone Ferry Terminal Study Cost Analysis of Alternative Courses of Action, Dated 1/5/05



Option: KS-1 Keystone Special - Existing Harbor - In Constant Dollars

		Low-End Estimated Cost in 2004 Dollars	Estimated Cost in 2004 Dollars	High-End Estimated Cost in 2004 Dollars	Mean Estimated Cost in 2004 Dollars	High-End Risk Factors Total
KS-1	**Keystone Special - Existing Harbor**					**0.22**
	Terminal Construction	$ 5.2	$ 6.9	$ 7.4	$ 6.5	0.07
	Terminal Preservation	$ 19.7	$ 20.7	$ 22.8	$ 21.0	0.00
	Terminal Maintenance	$ 2.4	$ 2.5	$ 2.8	$ 2.5	0.00
	Terminal Operations	$ 14.5	$ 14.5	$ 16.0	$ 15.0	0.00
	Vessel Construction	$ 108.9	$ 121.0	$ 157.3	$ 129.1	0.30
	Vessel Preservation	$ 107.1	$ 119.0	$ 160.7	$ 128.9	0.35
	Vessel Maintenance	$ 46.8	$ 52.0	$ 70.2	$ 56.3	0.35
	Vessel Operations	$ 168.3	$ 187.0	$ 202.0	$ 185.8	0.08
	Range	**$ 472.8**	**$ 523.6**	**$ 639.0**		
			Mean Cost in 2004 Constant Dollars		**$ 545.1**	

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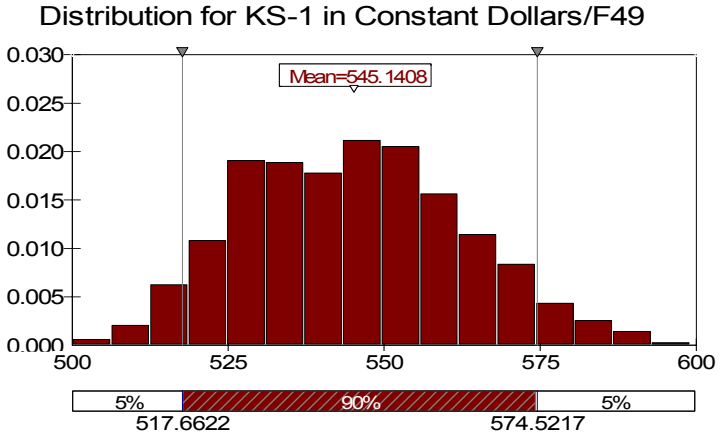

Option: 130-2 w/ Jetty Extension - In Constant Dollars

		Low-End Estimated Cost in 2004 Dollars	Estimated Cost in 2004 Dollars	High-End Estimated Cost in 2004 Dollars	Mean Estimated Cost in 2004 Dollars	High-End Risk Factors Total
130-2	**130-2 w/ Jetty Extension**					**0.08**
	Terminal Construction	$ 36.0	$ 46.0	$ 48.0	$ 43.3	0.04
	Terminal Preservation	$ 8.6	$ 9.0	$ 9.9	$ 9.2	0.10
	Terminal Maintenance	$ 2.9	$ 3.0	$ 3.3	$ 3.1	0.10
	Terminal Operations	$ 19.0	$ 19.0	$ 20.9	$ 19.6	0.10
	Vessel Construction	$ 86.0	$ 95.6	$ 105.2	$ 95.6	0.10
	Vessel Preservation	$ 66.4	$ 73.8	$ 81.2	$ 73.8	0.10
	Vessel Maintenance	$ 25.1	$ 27.9	$ 30.7	$ 27.9	0.10
	Vessel Operations	$ 149.4	$ 166.0	$ 174.3	$ 163.2	0.05
	Range	**$ 393.4**	**$ 440.3**	**$ 473.4**		
			Mean Cost in 2004 Constant Dollars		**$ 435.7**	

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Low-end of Vessel Cost Removes 'Assumed' 10% Contingency
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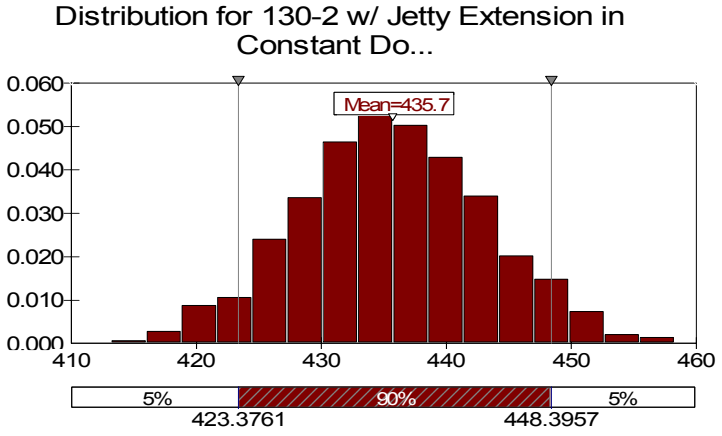
All Estimated Costs came from Keystone Ferry Terminal Study Cost Analysis of Alternative Courses of Action, Dated 1/5/05



Option: 130-7Jetty Relocation - In Constant Dollars

		Low-End Estimated Cost in 2004 Dollars	Estimated Cost in 2004 Dollars	High-End Estimated Cost in 2004 Dollars	Mean Estimated Cost in 2004 Dollars	High-End Risk Factors Total
130-7	**130-7 Jetty Relocation**					**0.08**
	Terminal Construction	$ 23.0	$ 28.5	$ 30.5	$ 27.3	0.07
	Terminal Preservation	$ 8.5	$ 8.9	$ 9.8	$ 9.0	0.00
	Terminal Maintenance	$ 2.4	$ 2.5	$ 2.8	$ 2.5	0.00
	Terminal Operations	$ 19.3	$ 19.3	$ 21.2	$ 19.9	0.00
	Vessel Construction	$ 86.0	$ 95.6	$ 105.2	$ 95.6	0.10
	Vessel Preservation	$ 66.4	$ 73.8	$ 81.2	$ 73.8	0.10
	Vessel Maintenance	$ 25.1	$ 27.9	$ 30.7	$ 27.9	0.10
	Vessel Operations	$ 149.4	$ 166.0	$ 174.3	$ 163.2	0.05
	Range	**$ 380.1**	**$ 422.5**	**$ 455.7**		
			Mean Cost in 2004 Constant Dollars		**$ 419.4**	

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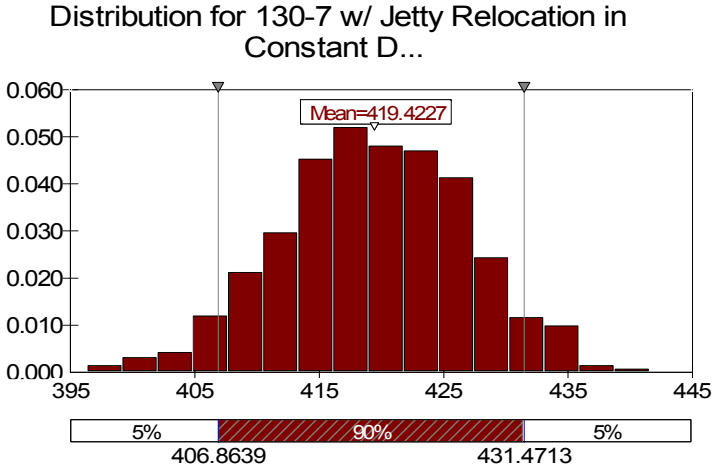

Option: NP-1 'New Vessel w/ Special Propulsion' - In Existing Harbor- In Current (YOE) Dollars

		Low-End Estimated Cost in Current (YOE) Dollars	Estimated Cost in Current (YOE) Dollars	High-End Estimated Cost in Current (YOE) Dollars	Mean Estimated Cost in Current (YOE) Dollars	High-End Risk Factors Total
NP-1	**New Vessel w/ Special Propulsion'**					**0.30**
	Terminal Construction	$ 5.7	$ 7.6	$ 8.0	$ 7.1	0.05
	Terminal Preservation	$ 28.2	$ 29.7	$ 32.7	$ 30.2	0.10
	Terminal Maintenance	$ 5.0	$ 5.3	$ 5.8	$ 5.4	0.10
	Terminal Operations	$ 30.8	$ 30.8	$ 33.9	$ 31.8	0.10
	Vessel Construction	$ 106.1	$ 117.9	$ 176.9	$ 133.6	0.50
	Vessel Preservation	$ 186.9	$ 207.7	$ 321.9	$ 238.8	0.55
	Vessel Maintenance	$ 64.7	$ 71.9	$ 111.4	$ 82.7	0.55
	Vessel Operations	$ 333.1	$ 370.1	$ 399.7	$ 367.6	0.08
	Range	**$ 760.6**	**$ 841.0**	**$ 1,090.3**		
			Mean Cost in Current (YOE) Dollars		**$ 897.3**	

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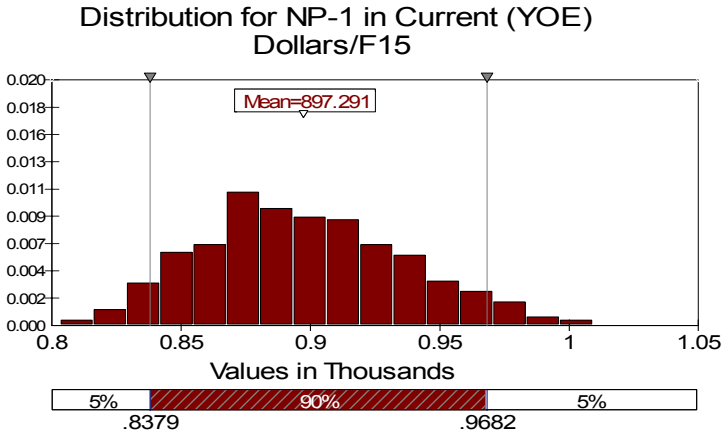

Option: KS-1 Keystone Special - in Existing Harbor - In Current (YOE) Dollars

		Low-End Estimated Cost in Current (YOE) Dollars	Estimated Cost in Current (YOE) Dollars	High-End Estimated Cost in Current (YOE) Dollars	Mean Estimated Cost in Current (YOE) Dollars	High-End Risk Factors Total
KS-1	**Keystone Special - Existing Harbor**					**0.22**
	Terminal Construction	$ 5.7	$ 7.6	$ 8.0	$ 7.1	0.05
	Terminal Preservation	$ 28.2	$ 29.7	$ 32.7	$ 30.2	0.10
	Terminal Maintenance	$ 5.0	$ 5.3	$ 5.8	$ 5.4	0.10
	Terminal Operations	$ 30.8	$ 30.8	$ 33.9	$ 31.8	0.10
	Vessel Construction	$ 119.7	$ 133.0	$ 172.9	$ 141.9	0.30
	Vessel Preservation	$ 299.7	$ 333.0	$ 449.6	$ 360.8	0.35
	Vessel Maintenance	$ 99.9	$ 111.0	$ 149.9	$ 120.3	0.35
	Vessel Operations	$ 368.1	$ 409.0	$ 441.7	$ 406.3	0.08
	Range	**$ 957.2**	**$ 1,059.4**	**$ 1,294.4**		
			Mean Cost in Current (YOE) Dollars		**$ 1,103.7**	

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Low-end of Vessel Cost Removes 'Assumed' 10% Contingency
High-end of Vessel Cost is based on a composite of 6 Risk Factors
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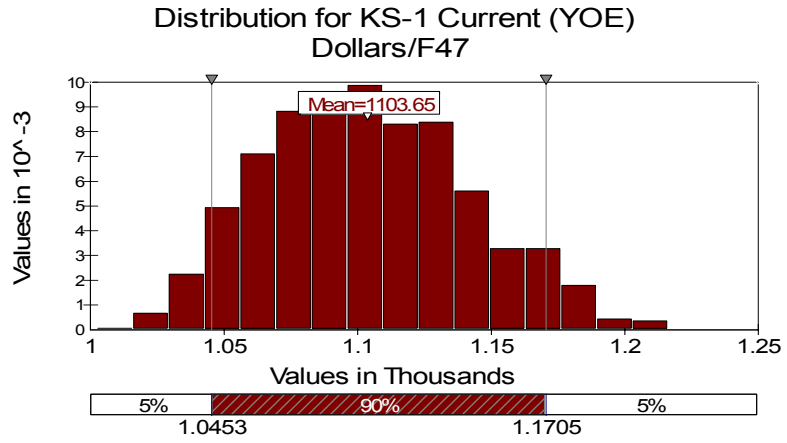

Option: 130-2 w/ Jetty Extension - In Current (YOE) Dollars

		Low-End Estimated Cost in Current (YOE) Dollars	Estimated Cost in Current (YOE) Dollars	High-End Estimated Cost in Current (YOE) Dollars	Mean Estimated Cost in Current (YOE) Dollars	High-End Risk Factors Total
130-2	**130-2 w/ Jetty Extension**					**0.07**
	Terminal Construction	$ 37.2	$ 51.0	$ 53.0	$ 47.1	0.04
	Terminal Preservation	$ 20.9	$ 22.0	$ 24.2	$ 22.4	0.10
	Terminal Maintenance	$ 4.8	$ 5.0	$ 5.5	$ 5.1	0.10
	Terminal Operations	$ 33.0	$ 33.0	$ 36.3	$ 34.1	0.10
	Vessel Construction	$ 96.3	$ 107.0	$ 117.7	$ 107.0	0.10
	Vessel Preservation	$ 165.0	$ 183.3	$ 201.6	$ 183.3	0.10
	Vessel Maintenance	$ 53.3	$ 59.2	$ 65.1	$ 59.2	0.10
	Vessel Operations	$ 320.6	$ 356.2	$ 374.0	$ 350.3	0.05
	Range	**$ 731.0**	**$ 816.7**	**$ 877.4**		
			Mean Cost in Current (YOE) Dollars		**$ 808.4**	

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Low-end of Vessel Cost Removes 'Assumed' 10% Contingency
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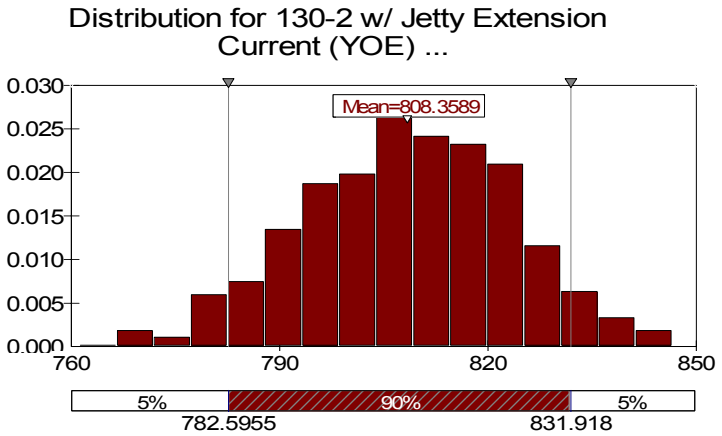

Option: 130-7 w/ Jetty Relocation - In Current (YOE) Dollars

		Low-End Estimated Cost in Current (YOE) Dollars	Estimated Cost in Current (YOE) Dollars	High-End Estimated Cost in Current (YOE) Dollars	Mean Estimated Cost in Current (YOE) Dollars	High-End Risk Factors Total
130-7	**130-7 w/ Jetty Relocation**					**0.08**
	Terminal Construction	$ 24.7	$ 31.3	$ 33.4	$ 29.8	0.07
	Terminal Preservation	$ 20.5	$ 21.6	$ 23.8	$ 22.0	0.10
	Terminal Maintenance	$ 5.0	$ 5.3	$ 5.8	$ 5.4	0.10
	Terminal Operations	$ 19.3	$ 40.9	$ 45.0	$ 35.1	0.10
	Vessel Construction	$ 96.3	$ 107.0	$ 117.7	$ 107.0	0.10
	Vessel Preservation	$ 165.0	$ 183.3	$ 201.6	$ 183.3	0.10
	Vessel Maintenance	$ 53.3	$ 59.2	$ 65.1	$ 59.2	0.10
	Vessel Operations	$ 320.6	$ 356.2	$ 374.0	$ 350.3	0.05
	Range	**$ 704.7**	**$ 804.8**	**$ 866.4**		
			Mean Cost in Current (YOE) Dollars		**$ 792.0**	

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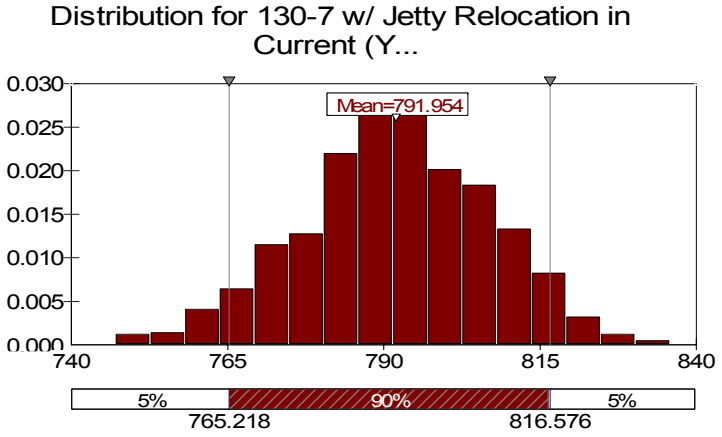

Option: NP-1 'New Vessel w/ Special Propulsion' - In Existing Harbor- In PV Dollars

		Low-End Estimated Cost in PV Dollars	Estimated Cost in PV Dollars	High-End Estimated Cost in PV Dollars	Mean Estimated Cost in PV Dollars	High-End Risk Factors Total
NP-1	**New Vessel w/ Special Propulsion'**					**0.32**
	Terminal Construction	$ 4.4	$ 5.8	$ 6.1	$ 5.4	0.05
	Terminal Preservation	$ 14.3	$ 15.1	$ 16.6	$ 15.4	0.10
	Terminal Maintenance	$ 1.1	$ 1.2	$ 1.3	$ 1.2	0.10
	Terminal Operations	$ 7.1	$ 7.1	$ 7.8	$ 7.3	0.10
	Vessel Construction	$ 78.4	$ 87.1	$ 130.7	$ 98.7	0.50
	Vessel Preservation	$ 26.1	$ 29.0	$ 45.0	$ 33.4	0.55
	Vessel Maintenance	$ 14.7	$ 16.3	$ 25.3	$ 18.8	0.55
	Vessel Operations	$ 75.2	$ 83.5	$ 90.2	$ 83.0	0.08
	Range	**$ 221.3**	**$ 245.1**	**$ 323.0**		
			Mean Cost in PV Dollars		**$ 263.1**	

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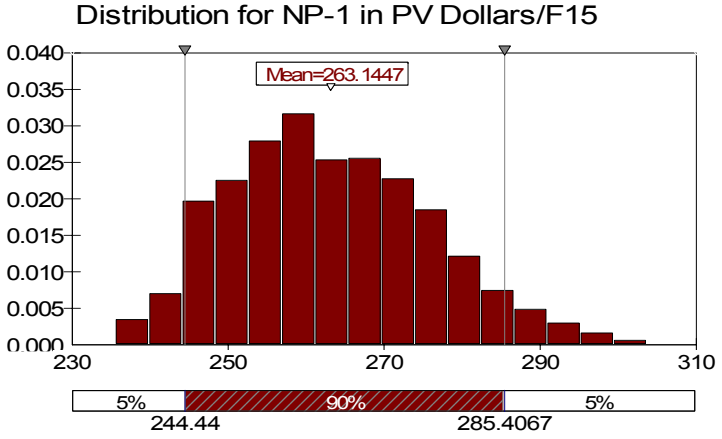

Option: KS-1 Keystone Special - in Existing Harbor - In PV Dollars

		Low-End Estimated Cost in PV Dollars	Estimated Cost in PV Dollars	High-End Estimated Cost in PV Dollars	Mean Estimated Cost in PV Dollars	High-End Risk Factors Total
KS-1	**Keystone Special in Existing Harbor**					**0.22**
	Terminal Construction	$ 4.4	$ 5.8	$ 6.1	$ 5.4	0.05
	Terminal Preservation	$ 14.3	$ 15.1	$ 16.6	$ 15.4	0.10
	Terminal Maintenance	$ 1.1	$ 1.2	$ 1.3	$ 1.2	0.10
	Terminal Operations	$ 7.1	$ 7.1	$ 7.8	$ 7.3	0.10
	Vessel Construction	$ 88.2	$ 98.0	$ 127.4	$ 104.5	0.30
	Vessel Preservation	$ 40.5	$ 45.0	$ 60.8	$ 48.8	0.35
	Vessel Maintenance	$ 22.5	$ 25.0	$ 33.8	$ 27.1	0.35
	Vessel Operations	$ 79.2	$ 88.0	$ 95.0	$ 87.4	0.08
	Range	**$ 257.4**	**$ 285.2**	**$ 348.8**		
			Mean Cost in PV Dollars		**$ 297.1**	

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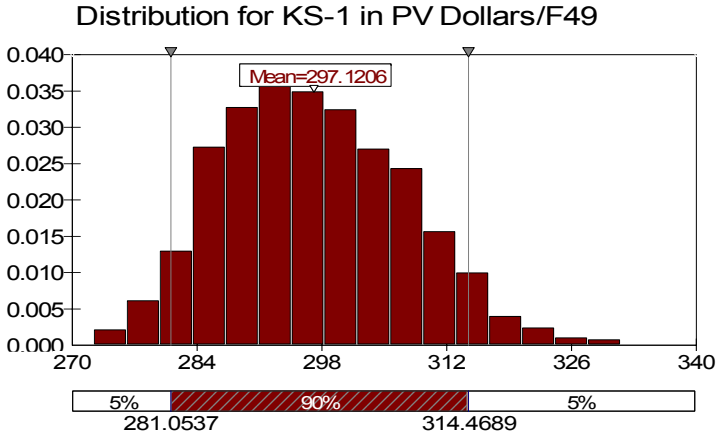

Option: 130-2 w/ Jetty Extension - In PV Dollars

		Low-End Estimated Cost in PV Dollars	Estimated Cost in PV Dollars	High-End Estimated Cost in PV Dollars	Mean Estimated Cost in PV Dollars	High-End Risk Factors Total
130-2	**130-2 w/Jetty Extension**					**0.08**
	Terminal Construction	$ 31.2	$ 38.6	$ 40.4	$ 36.7	0.05
	Terminal Preservation	$ 3.8	$ 4.0	$ 4.4	$ 4.1	0.10
	Terminal Maintenance	$ 1.0	$ 1.0	$ 1.1	$ 1.0	0.10
	Terminal Operations	$ 9.0	$ 9.0	$ 9.9	$ 9.3	0.10
	Vessel Construction	$ 72.5	$ 80.6	$ 88.7	$ 80.6	0.10
	Vessel Preservation	$ 27.4	$ 30.4	$ 33.4	$ 30.4	0.10
	Vessel Maintenance	$ 12.2	$ 13.6	$ 15.0	$ 13.6	0.10
	Vessel Operations	$ 71.6	$ 79.5	$ 83.5	$ 78.2	0.05
	Range	**$ 228.6**	**$ 256.7**	**$ 276.4**		
			Mean Cost in PV Dollars		**$ 253.9**	

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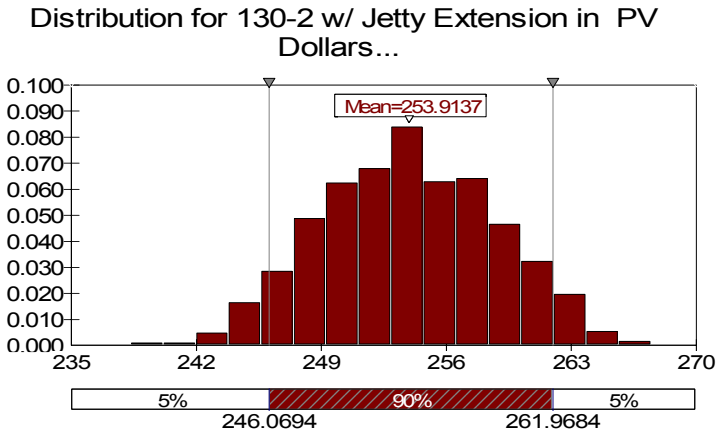
All Estimated Costs came from Keystone Ferry Terminal Study Cost Analysis of Alternative Courses of Action, Dated 1/5/05



Option: 130-7 w/ Jetty Relocation - In PV Dollars

		Low-End Estimated Cost in PV Dollars	Estimated Cost in PV Dollars	High-End Estimated Cost in PV Dollars	Mean Estimated Cost in PV Dollars	High-End Risk Factors Total
130-7	**130-7 w/ Jetty Relocation**					**0.08**
	Terminal Construction	18.9	$ 23.9	$ 25.7	$ 22.8	0.08
	Terminal Preservation	$ 3.4	$ 3.6	$ 4.0	$ 3.7	0.10
	Terminal Maintenance	$ 1.1	$ 1.2	$ 1.3	$ 1.2	0.10
	Terminal Operations	$ 8.9	$ 9.4	$ 10.3	$ 9.6	0.10
	Vessel Construction	$ 72.5	$ 80.6	$ 88.7	$ 80.6	0.10
	Vessel Preservation	$ 27.4	$ 30.4	$ 33.4	$ 30.4	0.10
	Vessel Maintenance	$ 12.2	$ 13.6	$ 15.0	$ 13.6	0.10
	Vessel Operations	$ 71.6	$ 79.5	$ 83.5	$ 78.2	0.05
	Range	**$ 216.1**	**$ 242.2**	**$ 261.9**		
			Mean Cost in PV Dollars		**$ 240.1**	

Low-end of Terminal Construction Cost Removes 30% Design Contingency
Low-end of Vessel Cost Removes 'Assumed' 10% Contingency
High-end of Vessel Cost is based on a composite of 6 Risk Factors
All Estimated Costs came from Keystone Ferry Terminal Study Cost Analysis of Alternative Courses of Action, Dated 1/5/05